

The claims are directed to cracking catalysts in particulate form composed of at least 70 weight percent zeolite and an alumina sol matrix. The preferred embodiment of the claimed invention requires at least about 80 weight percent zeolite of Y types.

The high zeolite content catalysts of the present invention are particulate materials composed of a combination of at least 70 weight percent zeolite having high energy and an alumina sol matrix. This combination has been unexpectedly found to exhibit the combined properties of high kinetic conversion activity, low attrition properties as well as high bulk density, surface area and pore volume, which makes the resultant catalyst highly desired for certain FCC applications, such as that described in co-pending U. S. patent application Serial No. 09/833,601, filed concurrently with the present application. Although each of these properties has been previously sought and, in certain instances, attained, the combination of said properties has not been previously provided. Further, although prior teachings has included reference to high zeolite content catalysts, those skilled in the art have been directed away from such material as they are generally known to cause high levels of coke formation in FCC units.

The Examiner has rejected certain claims under 35 U.S.C. §112 as being indefinite due to the terminology used therein. Applicants respectfully submit that the claims presently submitted fully overcome the objections raised by the Examiner. Withdrawal of the rejection is respectfully solicited.

Claims 35-37 are submitted with the phrase "in amounts in the range of" as suggested by the Examiner for Claims 5-7. Further, the term "a Y type zeolite," as used in original Claims 8, 23 and 24, has been replaced by the term -- zeolite of Y types-- to refer to the class of zeolites having a Y structure, as described on Page 8 of the instant application. The class of zeolites of Y types include standard Y, USY, REY, REUSY, CREY, CREUSY and the like, as is well known to those skilled in this art.

It is respectfully submitted that the claims, as presently submitted, are in accordance with the mandates of 35 U.S.C. §112. The rejection under 35 U.S.C. §112 should, therefore, be withdrawn.

The Examiner has objected to the specification based on the contention that the reference made, at page 7, third paragraph, to "Table 1 below" is not proper as no Table 1 appears on page 7 of the present application. It is respectfully submitted that the reference to "Table 1 below" correctly refers to Table 1 located on page 15a of the present specification. The word "below" is not limited to text on the same page but merely to text or other identified item (e.g., Table) further on in the reading of the same specification.

To aid in the discussion herein below, Applicants believe it would be helpful to discuss each of the properties of the combination of properties achieved by the present catalyst.

1. Kinetic Conversion Activity refers to the microactivity (according to ASTM-5154) of a cracking catalyst. Although very high activity may be desired, it has not been sought after due to the increase in coke formation in the FCC unit normally attributed to catalysts of very high activity, as required by the present claims..

2. Davison Attrition Index (DI) is a measure of a catalyst product resistance to conversion to undesirable fines under conventional forces encountered in an FCCU. Thus, the lower the DI value, the more desirable the catalyst is for FCC application.

3. Bulk Density refers to average density of a catalyst product. High bulk density (g/m^3) is desired to increase the amount of catalyst being retained in the FCCU and not carried out by the exit stream.

4. H_2O pore volume is a measure of the pore structure of the catalyst. Pore volume of greater than 0.32 cc/g is highly desired to provide a catalyst product capable of ingress of large hydrocarbon molecules and egress of the cracked product.

5. Surface Area of the catalyst should be high in order to provide high degrees of active sites to contact the hydrocarbon feed being treated. Surface area of greater than 500 m²/g is highly desired and attainable by the present catalyst.

It should be noted that high pore volume and high surface area normally are counter to achieving products capable of exhibiting low attrition.

The Examiner has rejected Claims 1-9, 15-17 and 20 under 35 U.S.C. §102(b) as being anticipated by the teachings of Wachter et al. It is respectfully submitted that this rejection should be withdrawn in view of the newly submitted claims and the remarks herein below.

It is respectfully submitted that Wachter et al. does not disclose nor suggest the presently claimed invention directed to catalysts having very high zeolite content of at least 70 weight percent in an alumina sol matrix. Applicants have unexpectedly found that very high content zeolite catalyst can be formed with respectively low amounts of alumina sol to produce a catalyst particulate having very high kinetic activity, surface area, pore volume and bulk density while having low attrition. Thus, the catalyst product is highly desired for FCC applications.

Wachter et al. does not disclose nor suggest the use of an alumina sol as the catalyst matrix. Further, the reference does not suggest that one would be able to form a durable, high density particulate suitable for FCC applications.

In view of the claims presently submitted, withdrawal of the rejection under 35 U.S.C. §102 based on Wachter et al. is respectfully solicited.

The Examiner has rejected all of the claims under 35 U.S.C. §102(b) as being anticipated by the teachings of Kumar et al. It is respectfully submitted that this rejection should be withdrawn in view of the presently submitted claims and the remarks herein below.

The claims presently submitted are directed to a combination of at least 70 weight percent zeolite with the remainder being alumina sol. In contrast, the teachings of Kumar et al. is directed to lower amounts of zeolite in a matrix

which requires the presence of a Cs material, such as pollucite. The presently claimed catalyst is not directed to such a catalyst, as taught or suggested by Kumar et al.

Withdrawal of the rejection under 35 U.S.C. §102 over Kumar et al. is respectfully solicited.

The Examiner has rejected Claims 1-8, 15-16 and 20 over the teachings of Connolly et al. It is respectfully submitted that this rejection should be withdrawn in view of the presently submitted claims and the remarks herein below.

Connolly et al. discloses zeolitic molecular sieves which are bonded to separately introduced silica sol particles. The resultant product is taught to be useful as an adsorbent material. The zeolites taught useful (see column 3, lines 31-53) have a $\text{SiO}_2/\text{Al}_2\text{O}_3$ molar ratio of at least 18, preferably at least 35. Such high silica content zeolites are known not to be suitable for cracking catalyst application and, thus, the reference's teaching would not be deemed applicable by the artisan to suggestions related to cracking catalyst compositions. Further, it is well known that high silica zeolites do not provide compositions of high kinetic activity, as required by the presently claimed invention. Clearly, neither the composition nor the utility referred to by Connolly et al. can be deemed to teach or suggest the presently claimed invention.

Withdrawal of the rejection under 35 U.S.C. §102 over Connolly et al. is respectfully solicited.

As discussed above, each of the cited references teaches formation of zeolitic products using silica sol as the matrix material. Connolly et al. teaches adsorbents composed of a combination of zeolitic particles with silica sol particles. Kumar et al. teaches FCC catalysts composed of zeolites in an inorganic silica sol or alumina sol matrix, which must contain pollucite or other Cs containing material. Wachter teaches FCC catalysts composed of silica sol. Thus, none of the cited references teach the present catalyst composition formed from a high content of high kinetic energy zeolite with an alumina sol to

unexpectedly provide a product having the combined desired properties described above.

Applicants herewith submit a Declaration under 37 C.F.R. 1.132 in which a showing is made that establishes that the desired combination of properties are attained by the presently claimed invention and to make a back-to-back comparison to the teachings of the prior art, as represented by Wachter et al. Specifically, the comparison is made to (1) a catalyst formed according to the showing of Example 4 of Wachter et al. composed of a zeolite and a silica sol; and (2) a catalyst formed according to Wachter et al. with a high zeolite content. Specifically, the comparison is made among:

1. Sample 1 – This sample is a replicate of Wachter et al.'s Example 4. It is noted that Wachter et al. illustrate their invention using conventional amounts of REY zeolite in a silica sol matrix. Wachter et al. illustrative examples forming low zeolite content catalysts directs one away from high zeolite content catalysts, as presently required. Further, Declarant shows that although this catalyst has suitable DI and bulk density, it does not have the pore volume or kinetic activity achieved by the presently claimed catalyst.

2. Sample 2 is submitted by Declarant to provide a showing directed to a catalyst formed with the maximum amount (80%) of REUSY zeolite, the minimum amount (5%) of Gibbsite and the remainder being a silica sol. It must be noted that although this product achieved the presently required kinetic activity, it was a friable, light material as shown by the very high Davison Attrition Index value of 54 and the low bulk density of the material of 0.43 g/cc³. Such a product would not be suitable for FCC applications.

3. Sample 3 is submitted by Declarant as a representative catalyst of the presently claimed invention. The catalyst is composed of 75 weight percent REUSY zeolite, and the remainder composed of alumina sol. In contrast to each of the above illustrative examples of the prior art, the present catalyst unexpectedly

achieves the desired combination of high kinetic conversion activity of greater than 3, high pore volume of greater than 0.32 cm³/g, high surface area of greater than 500 m²/g, high bulk density of greater than 0.6 g/cc and very low Davison Attrition Index of less than 20.

Declarant, as one skilled in this art, states that the presently claimed catalyst composition is distinct from and not taught nor suggested by Wachter et al as well as the teachings of the remaining cited references.

It is respectfully submitted that the Declaration made under 37 C.F.R. 1.132 clearly establishes that the presently claimed invention is patentably distinct from the prior art teachings.

The Examiner has rejected Claims 3-4, 15/3 and 15/4 under 35 U.S.C. §103 as being obvious over Wachter et al. in view of Chester et al.

The defects of Wachter et al. are discussed herein above. It is respectfully submitted that Chester et al. does not overcome the defects of the primary reference to make obvious the instantly claimed invention.

Withdrawal of the rejection is respectfully solicited.

The Examiner has rejected Claims 10 and 18 under 35 U.S.C. §103 as being obvious over Wachter et al. in view of Herbst et al.

The defects of Wachter et al. are discussed herein above. It is respectfully submitted that Herbst et al. does not overcome the defects of the primary reference to make obvious the instantly claimed invention.

Withdrawal of the rejection is respectfully solicited.

The Examiner has rejected Claims 21-26 and 31 under 35 U.S.C. §103 as being obvious over Wachter et al. in view of Rheume et al.

The defects of Wachter et al. are discussed herein above. It is respectfully submitted that Rheume et al. does not overcome the defects of the primary reference to make obvious the instantly claimed invention.

Withdrawal of the rejection is respectfully solicited.

The Examiner has rejected Claims 27 and 28 under 35 U.S.C. §103 as being obvious over Wachter et al. in view of Rheaume et al. and Herbst et al.

The defects of Wachter et al. are discussed herein above. It is respectfully submitted that Rheaume et al. and Herbst et al. do not overcome the defects of the primary reference to make obvious the instantly claimed invention.

Withdrawal of the rejection is respectfully solicited.

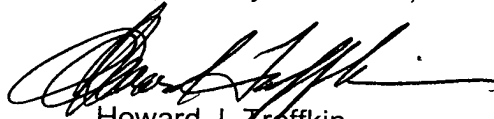
The Examiner has rejected Claims 3, 4 and Claims 11 and 15 as dependent on Claims 3 or 4 under 35 U.S.C. §103 as being obvious over Kumar et al. in view of Chester et al.

The defects of Kumar et al. are discussed herein above. Chester et al. does not overcome the defects of the primary reference to make obvious the instantly claimed invention.

Withdrawal of the rejection is respectfully solicited.

Applicants believe the Examiner will agree that the presently claimed invention is patentably distinct and that the application is in condition for allowance. Such action is respectfully solicited.

Respectfully submitted,



Howard J. Troffkin
Attorney for Applicants
Reg. No. 25,184

Tel: (410) 531-4518
W. R. Grace & Co.-Conn.
7500 Grace Drive
Columbia, Maryland 21044